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K.K. Bolsen

John E. Shirley

A. Laytimi

See next page for additional authors

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Abstract

Whole-plant grain sorghum silage and Silo-Best-Soluble inoculated and uninoculated control corn silages were compared in complete-mixed diets for mid-lactation dairy cows. Cows fed the inoculated corn silage yielded .6 lb and those fed the grain sorghum silage yielded 1.7 lb more fat-corrected milk than those fed the control corn silage. Fat percentage for the cows fed the grain sorghum silage was .2 units greater than for those fed the control and the inoculated corn silages. Similar percentages were obtained for milk protein and solids-not-fat. Cows fed the inoculated corn silage had the highest weight gain (+150 lb), those fed the control corn silage had intermediate gains (+132 lb), and those fed the grain sorghum silage had the lowest gains (+106 lb). We conclude that dairy farmers can derive positive responses from inoculation of corn silage and that grain sorghum silage can be substituted for corn silage in mid-lactation dairy cow diets.; Dairy Day, 1989, Kansas State University, Manhattan, KS, 1989; The 1989 Annual KSU Dairy Day is known as Dairy Day, 1989

Keywords

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Authors

K.K. Bolsen, John E. Shirley, A. Laytimi, and J. Dickerson

WHOLE-PLANT GRAIN SORGHUM AND INOCULATED CORN SILAGES IN MID-LACTATION DAIRY COW DIETS

K. K. Bolsen, J. E. Shirley, A. Laytimi, and J. Dickerson

Summary

Whole-plant grain sorghum silage and Silo-Best-Soluble[1] inoculated and uninoculated control corn silages were compared in complete-mixed diets for mid-lactation dairy cows. Cows fed the inoculated corn silage yielded .6 lb and those fed the grain sorghum silage yielded 1.7 lb more fat-corrected milk than those fed the control corn silage. Fat percentage for the cows fed the grain sorghum silage was .2 units greater than for those fed the control and the inoculated corn silages. Similar percentages were obtained for milk protein and solids-not-fat. Cows fed the inoculated corn silage had the highest weight gain (+150 lb), those fed the control corn silage had intermediate gains (+132 lb), and those fed the grain sorghum silage had the lowest gains (+106 lb). We conclude that dairy farmers can derive positive responses from inoculation of corn silage and that grain sorghum silage can be substituted for corn silage in mid-lactation dairy cow diets.

Introduction

Corn is the silage crop preferred by Kansas dairy farmers. Under favorable environments, corn will usually have adequate nutrients, sufficient dry matter, and a natural microflora that often leads to a successful silage fermentation. Therefore, farmers often question the benefits to fermentation from microbial inoculation of corn silage and whether these benefits would translate into better animal gains and more milk production. In addition, in Kansas, the leading state in sorghum silage production, rainfall does not always favor optimum corn production. Because of its greater drought resistance, grain sorghum silage would be a more available feed than corn under limited rainfall. The objectives of this experiment were to examine the effect of inoculation of corn silage on milk production and to compare the feeding value of whole-plant grain sorghum silage to that of corn in diets for mid-lactation dairy cows.

Procedures

The two whole-plant Hoegemeyer 2689 corn silages compared were: (1) control (no additive) and (2) inoculated with Silo-Best Soluble®. The two silages were ensiled in two 16 × 50 ft concrete stave silos on August 6, 7, and 8, 1987 using the alternate load method. Prefermented inoculant was prepared 20 to 24 hr prior to use. On each of the three filling days, a PVC laboratory silo experiment was started, and silos were opened at 6, 12, 24, 48, and 96 hr postfilling to follow the ensiling dynamics of the control and inoculated corn silages. Grain sorghum NC+ 174 was used and ensiled

[1]Silo-Best Soluble® contains *S. faecium* M-74, *L. acidophilus, Pediococcus sp.,* and *L. plantarum* and is a product of Medipharm-USA, Des Moines, IA.

in an 8 × 125 ft Kelly Ryan bag on August 23 and 24, 1987. (For details on farm scale and PVC ensiling and sampling procedures see KAES Reports of Progress 448, 514, 539, and 567.)

Each of the three silages was fed to 20 Holstein cows (1380 lb average initial weight) in a 90-day mid-lactation (54 lb average initial milk per day) feeding trial. The cows were allocated to the silage rations according to days in milk, previous milk production, and lactation number. During a 15-day preliminary feeding period all cows were fed a diet containing corn silage (from a different source than the experimental corn silages), alfalfa hay, and a balanced concentrate mix. Three, consecutive, daily body weights were measured at the end of the preliminary period and averaged for an initial body weight. Cows in all three treatment groups were fed the experimental diets for a 6-day adaptation period. The diets were then fed for a 90-day period. The diets were completely mixed; contained 42% of the respective silage, 44% grain mix, and 14% chopped alfalfa hay; and were balanced for milk production according to NRC (1988) recommendations.

Individual cow milk production and group feed intake were recorded daily. Milk was sampled weekly for determination of milk fat, protein, solids-non-fat (SNF), lactose, and somatic cell count.

Cows were housed according to treatment and fed the total mixed diet in a fence-line bunk via a feed mixer wagon equipped with an electronic scale. Cows were fed twice daily in accordance with group average milk production, milk fat, and body weight.

Results and Discussion

Silage fermentation dynamics for the PVC control and inoculated corn silages are shown in Table 1. Both control and inoculated silages underwent very rapid fermentations, reaching a pH of 3.90 within the first 48 hr. Although inoculated silage fermented faster during the first 24 hr, as indicated by its pH drop and lactic acid production, the differences compared to the control were not significant. The 90-day fermentation end-products of both silages were very similar.

The fermentation products and composition of the control corn, inoculated corn, and grain sorghum silages at feeding are shown in Table 2. Fermentation products and pH were very similar for the control and inoculated corn silages. However, the grain sorghum silage had higher pH and acetic acid and lower lactic acid levels than the corn silages. The dry matter content, which averaged 35%, was similar for all the silages. The grain sorghum silage had higher protein (9.8 vs 7.5% of the dry matter) but lower content of acid detergent fiber (ADF) (23.5 vs 25.0% of the dry matter) than the corn silages.

Average daily dry matter intake, milk production and composition, and cow weight change are shown in Table 3. Although dry matter intake for all the silages was similar, total dry matter intake tended to be higher for the grain sorghum silage ration than for the corn silage rations.

Although daily milk production was also similar for all the silages, averaging 46.4 lb of fat-corrected milk (FCM), cows fed the inoculated corn silage yielded .6 lb and those fed the grain sorghum silage tended to yield 1.7 lb more fat-corrected milk than those fed the control corn silage. Cows fed the grain silage tended to produce 1.1 lb more fat-corrected milk than those fed the inoculated corn silage.

There were no differences among the silages for milk fat percentage (3.7% for the corn silages vs 3.9% for the sorghum silage). However, fat percentage for the cows fed the grain sorghum silage was .2 units greater than that for cows fed the control and the inoculated corn silages. Similar percentages were obtained with milk protein and solids-not-fat.

Weight change of the cows was different ($P<.05$) among the silages. Cows fed the inoculated corn silage had the highest weight gain (+150 lbs), those fed the control corn silage had intermediate gains (+132 lbs), and those fed the grain sorghum silage had the lowest gains (+106 lbs).

We conclude that dairy farmers may derive positive responses from inoculation of corn silage and that grain sorghum silage can be substituted for corn silage in diets for mid-lactation dairy cows.

Table 1. Initial Dry Matter, pH, and Fermentation Products over Time for Control and Inoculated Corn Silages

Time post-filling and item		Control	Inoculated
Initial dry matter, %		36.35	36.65
Hour 6:	pH	5.16	5.06
	Lactic acid[a]	.82	.88
Hour 12:	pH	4.44	4.35
	Lactic acid	1.91	2.13
Hour 24:	pH	4.34	4.25
	Lactic acid	2.91	3.13
Hour 48:	pH	3.91	3.90
	Lactic acid	4.56	4.71
Day 4:	pH	3.86	3.85
	Lactic acid	5.32	5.45
Day 90:	pH	3.92	3.91
	Lactic acid	7.10	7.29
	Acetic acid[a]	1.07	1.06
	Ethanol[a]	.83	.59
	NH_3-N[a]	.08	.08

[a]Expressed as a percentage of the silage dry matter.

Table 2. Fermentation Products, pH, and Chemical Composition of Corn and Grain Sorghum Silages Fed to Cows

Item	Corn		Grain sorghum
	Control	Inoculated	
pH	3.8	3.8	4.2
Fermentation products:	---------- % of the dry matter ----------		
Lactic acid	6.3	6.7	4.4
Acetic acid	1.5	1.5	3.6
NH_3-N	.10	.11	.17
Chemical composition:			
Dry matter, %	35.6	34.9	34.5
	---------- % of the dry matter ----------		
Crude protein	7.5	7.4	9.8
Acid detergent fiber	25.1	24.8	23.5

Table 3. Intake, Milk Yield and Composition, and Weight Change of Cows Fed Three Silage Rations

Item	Corn		Grain sorghum
	Control	Inoculated	
No. cows	20	20	20
Dry matter intake, lb/d:			
Silage	20.9	20.7	21.8
Grain	22.2	22.0	22.5
Hay	6.8	6.8	6.8
Total	50.0	49.5	51.1
Milk:			
Yield, lb			
Daily	47.8	48.4	48.0
Fat-corrected milk	45.6	46.2	47.3
Composition, %			
Fat,	3.7	3.7	3.9
Protein, %	3.4	3.4	3.4
Solids-not-fat	12.5	12.4	12.7
Weight change, lb	+132.0[a]	+150.0[b]	+106.0[c]

[abc]Means in the same row with different superscripts differ (P<.05).